

## DETECTION OF *SALMONELLA ENTERICA* IN SUBCLINICALLY INFECTED HERDS

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The nation-wide salmonella control program is based on serological monitoring of swine herds (meat juice samples taken at the slaughter line) and classification of the herds on the basis of serology (Mousing et al. 1997). When a herd is classified as a level 2 or level 3 herd (moderate or high sero-prevalence), a follow-up program is instituted. From August 1996, the follow-up program comprises: (1) a letter to the individual herd with information about the assigned salmonella level and the follow-up program (the injunction); (2) mandatory visits by veterinary advisors including a profile of the salmonella occurrence in the herd. The profile *must* comprise pen samples for bacteriological examination for *Salmonella enterica*; (3) a plan for interventions; and (4) penalties if the herd does not comply with the program. On the submission forms to the Danish Veterinary Laboratory DVL the individual samples can be marked. Materials from swine are typically marked with sow number, stable, unit, or age-group.

The objective was in a sample of herds with a moderate or high sero-prevalence measured in the meat juice screening to describe the salmonella occurrence — measured by bacteriological examination — in (1) farrow to finishing and finishing herds; (2) sows, piglets, growers, and finishers; and; (3) level 2 and level 3 herds.

## MATERIALS AND METHODS

The actual sampling frame was herds that submitted materials for the mandatory bacteriological examination to the DVL. The selection criteria were: (1) the date of injunction was between 1 July 1996 and 1 February 1997; (2) the samples were submitted directly from the veterinary advisor to the DVL; (3) the date of sampling was between 1 September 1996 and 31 January 1997; and (4) the submission form included additional information on age-group for the individual sample.

The data on injunctions and salmonella levels were extracted from the Central Zoonosis Register (ZOOR). The data on age-groups were entered in a spreadsheet (QuattroPro 6.0) and transferred to SAS (SAS 6.12). The data entry was ended mid February 1997.

In the study the following definitions were used:

- (1) Injunction: The letter informing the farmer about the follow-up program with the mandatory sampling, bacteriological examination, and possible penalties;
- (2) Minimum criteria for bacteriological examination: At least 5 pen samples and sufficient material (5×5 gram faeces per sample);
- (3) Follow-up positive herd: *Salmonella enterica* was isolated from at least one sample;
- (4) Follow-up positive age-group: *Salmonella enterica* was isolated from at least one sample;
- (5)

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Sows: Sows in other units than the farrowing unit including gilts; (6) Farrowing: The sample marked farrowing unit; (7) Weaners: Live weight 7 - 25 kg; age 4 - 10 weeks; or where the sample was marked nursery; (8) Growers: Live weight 26 - 45 kg; age from 10 weeks to 15-16 weeks; or sample marked "grower" on a submission form which differentiated between "growers" and "finishers"; (9) Finishers: Live weight 46 - 90 kg; age 4 - 6 months; or sample marked "finisher" on a submission form which differentiated between "growers" and "finishers"; and (10) Grower/finisher: No differentiation between grower and finisher was made on the submission form.

The follow-up prevalence regardless of age-group was calculated (number of bacteriological positive/number of samples per herd). The effect of herd type (Farrow to finishing or Finishing) and salmonella level at the injunction (level 2 or 3) on the follow-up status of the herd (FU-herd) was assessed in two-by-two tables and Mantel-Haenszel test statistic (proc freq, SAS vers 6.12).

## RESULTS

The study comprised 407 submissions representing 403 herds with a total of 806 age-groups examined. A total of 146 herds (129+17) were bacteriologically negative at the follow-up, but the risk of isolating *Salmonella enterica* was higher in level 3 herds (odds ratio = 1.888, p-value = 0.033) (Fig. 1). There was no effect of herd type (odds ratio (Farrow to finishing) = 1.214, p-value = 0.366).

**Figure 1. Bacteriological examination for *Salmonella enterica* in 407 submissions from 403 Danish swine herds. The effect of the salmonella level at the injunction on the follow-up status of the herd**

Herd follow-up:	Salmonella		
	Level 3	Level 2	
Positive	52	209	261
Negative	17	129	146
	69	338	407

The within herd follow-up prevalence ranged from 0 to 1 in herds with level 2 and herds with level 3 at the injunction (Fig. 2, upper diagrams). The proportion of positive herds seemed to be lower (20%) in the age-groups Sows and Farrow compared to Weaners, Growers, Grow/Fin, and Finishers (40-60%) (Fig. 2, lower diagrams).

## DISCUSSION

Overall it was a large sample of the submission to the DVL. The study included 67% (407/608) of the submissions in which a follow-up bacteriological examination was performed by submission of material to the DVL in the period from 1 September 1996 to 31 January 1997.

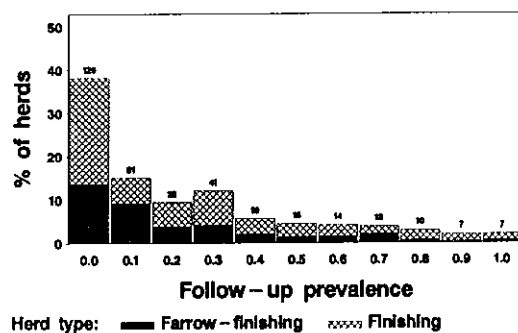
The quality of the data was high because: (1) the quality of the data concerning herd id, salmonella level, and date of injunction was extracted automatically from the source (ZOOR) where the salmonella level and date of injunction was first assigned; (2) the information on age-

group served as an identification of the individual sample. Therefore, it was assumed to be accurate on the submission forms and at the entry, the data were checked for consistency.

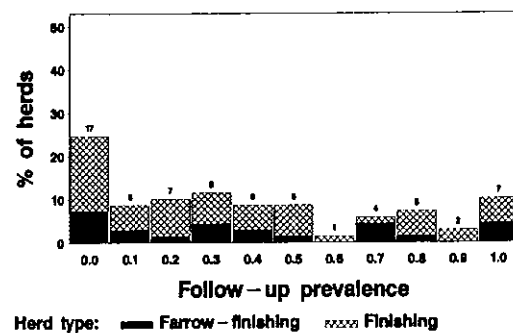
The increased risk of isolation of *Salmonella enterica* in level 3 herds compared to level 2 herds was expected because the levels are assigned to categorize the herds according to the salmonella occurrence.

**Figure 2. Salmonella occurrence in 407 submission from 403 Danish swine herds with salmonella level 2 or 3. The occurrence was measured by bacteriological examination of pen samples**

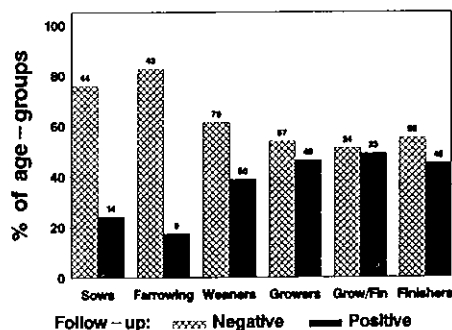
**Distribution of within herd prevalence  
Salmonella level 2**



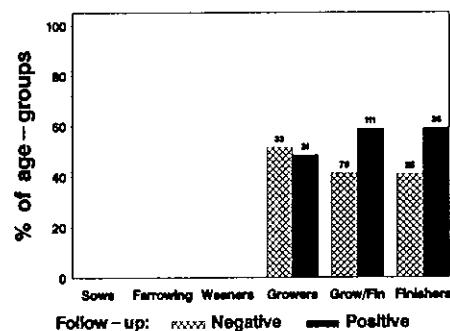
**Distribution of within herd prevalence  
Salmonella level 3**



**Distribution in age-groups  
Farrow to finishing herds**



**Distribution in age-groups  
Finishing herds**



Subclinical salmonella infection was a problem in pigs rather than in sows. The study showed no effect of herd type (Farrow to finishing or Finishing herds) on the occurrence of salmonella, but some care should be taken with regard to generalization of the results of this study because: (1) few herds were included; (2) the study period was limited to autumn and early winter; (3) the study was restricted to level 2 and level 3 herds; (4) the sensitivity of the bacteriological examination is low (50%); and (5) the sampling in the individual herd was not systematic.

## CONCLUSION

*Salmonella enterica* was isolated more frequently in level 3 than level 2 herds. *Salmonella enterica* was isolated more frequently from pigs (Weaners, Growers, or Finishers) than from sows (Sows and Farrowing).

## REFERENCES

Mousing J., Jensen P.T., Halgaard C., Bager F., Feld N., Nielsen B., Nielsen J.P., Bech-Nielsen S., 1997. Nation-wide *Salmonella enterica* surveillance and control in Danish slaughter swine herds. Prev. Vet. Med. 29. 247-261.